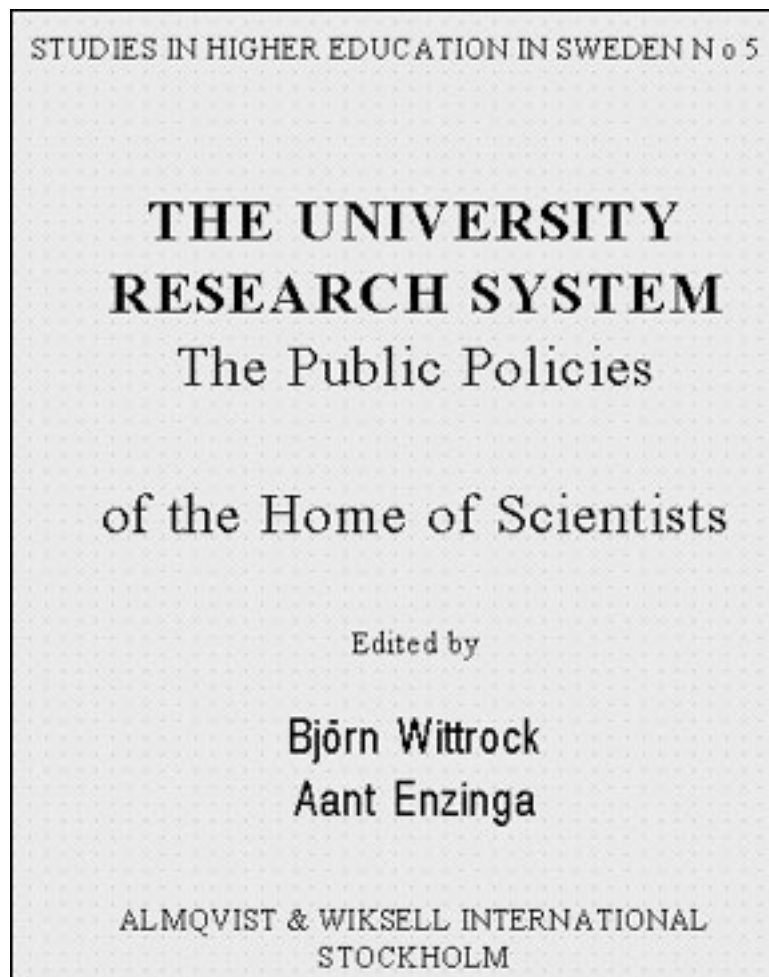


## **The Quest for University Research: Policies and Research Organization in Latin America**

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### **Established Assumptions and New Realities**

No one seriously disputes that the major universities in Western Europe and the United States are privileged locations for scientific research. To an external observer, the present debate on the role, extension and nature of university research in these countries - the extent of external influence, the

relationships between scientific and nonscientific traditions, the interplay between research, graduate education and undergraduate education, the problems of linkage between university and industry, etc. - is basically concerned with the fine-tuning of an otherwise sound and firmly entrenched research and educational establishment.

A broader historical and geographical perspective, however, shows that what would seem to be a natural interrelationship is in fact quite unusual. In other times and societies, higher education and scientific research have quite often been unrelated to each other; and even in Western Europe and the United States, a significant amount of scientific research is carried on outside of the universities, while most of the higher education institutions (whether operating under the name of "university" or not) are involved in very little or no research at all.

The often problematic relationship between scientific research and institutions of higher education is fairly obvious for those who follow the attempt to build up modern universities in societies without solid academic traditions or the problems faced by traditional and well-established universities in the context of rapidly expanding systems of higher education. The larger Latin American countries - Brazil, Mexico, Argentina, Venezuela, Chile - have faced these two problems simultaneously during the past decades<sup>1</sup>. Their institutions of higher education, previously open only to the heirs of the small elites in these countries, have rapidly evolved into large systems of mass education with hundreds of thousands of students. At the same time, a very limited tradition of scientific research in a few isolated institutions have given way to complex structures of science policy and administration and to fairly large networks of laboratories, research centers and graduate programs. During this process, new organizational structures have been superimposed on old ones, and new groups, without any previous experience with science or higher education, have been engaged in these activities - teachers, administrators, planners.

These events are obviously important in themselves. At the same time, they may have some heuristic value in understanding the realities of the more advanced and stable systems of university research and higher education for at least two reasons. First, they provide the observer with a range of differences and alternatives in social values and organizational arrangements that reveal that the value assumptions taken for granted in Western culture concerning the nature of education, research and organizational behavior are only a very limited subset of a much larger array of possibilities. And second, they call attention to the fact that, at its roots, institutions of higher education and scientific research are essentially the products of purposive social action - that, in order to understand their potentialities and predicaments, one should go beyond the facade of their institutional arrangements and into the motivations and value orientations of the actors involved.

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<sup>1</sup> An overview of the attempts to establish university research in a few of the larger Latin American countries can be found in the author's contribution, "The Focus on Scientific Activity", to Burton R. Clark, editor, *Perspectives in Higher Education: Eight Disciplinary and Comparative Views*, Berkeley, Los Angeles, London: University of California Press, 1984, pp 199-232. See also, for Brazil, S Schwartzman, "Struggling to be Born: The Scientific Community in Brazil", *Minerva* XVI, 4, 1978 pp. 545-580.

The changes in social motivation in relation to higher education in Latin America are related to the staggering differences in wages between uneducated and university trained people in these countries. In fact, it is not unusual in this region for a university-trained person to earn a salary that is twenty or more times that of an unskilled worker. These differences in salary mean that not only is the unskilled laborer poorer, but he also lives in a completely different social milieu, one in which life is structured on the basis of very little money and without access to the basic stability, amenities and consumption patterns of the modern sectors of his own society. Wage differentials reflect not only different market values of skills, but also unequal opportunities for access to different social positions (what economists have called "segmented labor markets"). In the past, when the number of highly educated people was very small, there was little difference between the privileges accorded the educated and those which characterized the social strata which supplied the bulk of students in higher education institutions. As these societies became more urbanized and industrialized demand for access to this privileged position through education increased. At the same time, more highly paying social positions were being created and for many years educational achievement became an effective ladder for social mobility.

This is the background against which one should understand the enormous pressure that transformed the Latin American scene and led to the massive expansion of its systems of higher education in the last decades<sup>2</sup>. There were at least two points of resistance to this trend. First there was generally very little capacity for expanding the systems of higher education in accordance with demand without substantial declines in quality. There were simply not enough teachers, laboratories or classrooms of sufficient quality and not enough money to provide them quickly enough. And second, there was a more or less diffuse perception that the privileges granted to the highly educated were dependent on keeping their numbers small. It is not surprising, therefore, that resistance to the expansion of higher education came mostly from among the well educated, who referred to the values of good academic standards and professional competence.

This resistance was, however, easily overpowered by a greater trend. For those entering an expanding educational system from below, a lower quality of education in a slightly more competitive labor market probably entailed somewhat fewer privileges than the older generation had, but still a substantial gain. This was combined with a questioning of the real value of the education provided by the traditional schools and universities. They were deemed to be too elitist, not very practical, not open enough to the new social realities, not attuned to the needs of the changing labor market, too backward scientifically. Some of these criticisms were inconsistent with each other; this suggests that they came from a rather broad spectrum of social groups and interests that joined forces to open the gates of the old universities. In this process, most of the assumptions that existed about the daily life of more stable educational systems came into question - the general importance of higher education for society, the standards of quality for teaching and

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<sup>2</sup> For a partial summary of the literature dealing with this process see Simon Schwartzman, "Politics and Academics in Latin American Universities", *Journal of Interamerican Studies and World Affairs*, August, 1983.

scholarship, the role of professors and students in academic and administrative life, the decision-making mechanisms in all areas. This challenge to previous assumptions was particularly evident in the Brazilian higher education reform of 1968, which was an attempt to reorganize the country's universities along the American departmental model.

Scientists have been a very active and influential group in the transformations described above. Whenever they could, they became active propagandists for higher education in general and spread the notion that scientific education should be a central component of its expansion. They tended to express the view that a national policy for scientific and technological development was essential if their countries were to reach the levels of development of the more advanced, northern societies. How they came to play this role and their relationships with other groups involved in the same process of social change is the subject of the following sections.

### **Scientists in Their Traditional Role**

The Latin American countries do not have a tradition of research universities. Scientific research in these countries, when it existed, tended to be concentrated to a few, isolated institutions: museums, observatories, agricultural research centers and some of their best schools of medicine. The Latin American universities in this century can be roughly characterized as displaying two features: first, a structure of quasi-independent "faculties" in the French sense, i.e., schools that have the authority, or faculty, to provide legally binding diplomas for the professions, and, second, the status of publicly supported corporations, with a significant ability to withstand external pressures and control.

Power and influence tended to be concentrated at the faculties, and not at the level of the chancellor or of individual institutes, departments or subdivisions of any kind. Decision-making usually included intense participation of professors, and often of students and alumni when a country's political climate allowed for it (this was the traditional tripartite system of "co-gobierno"). The important role played by professors did not necessarily mean that disciplinary commitments were as important in this system as they are in the "master matrix" that Burton Clark so well describes for the research universities in the developed countries, given the weakness of the local scientific communities<sup>3</sup>. The nomination of a university chancellor (or "reitor") was usually decided on the highest political level of the country, but often based on lists drawn up by the collegial boards of the universities. There were, of course, many variations on and deviations from this pattern: Catholic universities, private institutions, technical schools related to the armed forces and some branches of the civil service, and so on. In general, however, they tended to copy or to drift towards the "faculty" system described above.

Scientific research first entered this system as individual scholarship. Admission and promotion to the different degrees of professorship often required a public exam and the presentation of a thesis. A doctoral

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<sup>3</sup> For the "master matrix" concept, see Burton R. Clark, *The Higher Education System: Academic Organization in Cross-National Perspective*. Berkeley, Los Angeles and London: University of California Press, 1983.

degree was usually the first step in a professorial career, followed by others (associate professor, "livre-docente," "catedrático") which were associated with specific academic privileges and salaries. This was clearly an adoption of the traditional European pattern, but the probity and quality of this kind of merit system varied significantly from country to country and from faculty to faculty. At best, it created the conditions for individual scholarship, the production of a few erudite pieces of work, but not for a real tradition of continuous professional research. In the absence of well-equipped laboratories, libraries and research funds, scientists had to be fairly affluent to cover their own expenses. Personal resources were also necessary to travel abroad and maintain contact with scientists in more developed centers. As a consequence, university research tended to be, above all, the cultivated habit of a small elite. For them, conducting research was a characteristic of a civilized society, as important as playing good music and writing good literature.

A second channel for university research was the technical laboratories associated with the schools of engineering and, in particular, medicine. Improvements in the quality of medical teaching in some Latin American medical schools have led to the development of full-time professorships, the organization of university hospitals, the creation of specific research groups within the medical schools, and so on. This type of medical research has sometimes been of fairly high quality. Within the medical schools, however, it tended to be secondary to professional education and clinical practice and could not expand beyond certain limits.

The introduction of research through the traditional professional schools was often the result of technical assistance received from the more advanced countries or of professional and scientific training obtained by individuals abroad. In Brazil, as early as the 1910s, the Rockefeller Foundation was giving support to the school of medicine of Sao Paulo and pressing for full-time teaching and research. Argentina's early experience seems to have been more general and more endogenous. The University of Buenos Aires developed some significant research institutes in the first decades of this century, including the Ethnographic Museum, the Institute of Historical Research and, most notably, the Institute of Physiology of the School of Medicine under the leadership of Bernardo Houssay, Nobel laureate in medicine in 1974<sup>4</sup>.

### **Scientists as Activists**

There is a chapter still to be written about how the scientific ideology, previously restricted to very closed circles, started to gain momentum and reach sectors of the educational system and society in Latin America other than the schools of medicine and some isolated institutes<sup>5</sup>. The dissemination of this ideology eventually led to tensions between the research oriented professors and several of the other sectors of the universities - the students, the teachers, the administration. Students on the whole tended to be concerned

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<sup>4</sup> Tulio Halperin Donghi, *Historia de la Universidad de Buenos Aires*. Buenos Aires: Editorial Universitaria de Buenos Aires, 1962

<sup>5</sup> On "scientific ideology" and its role in providing space for scientific growth see Joseph Ben-David, *The Scientist's Role in Society*. Englewood Cliffs, N.J.: Prentice-Hall, Inc, 1972.

with obtaining their degrees and their right to work as professionals in a market which was, until recently, quasi-monopolized by the holders of diplomas (technical competence was seldom a decisive factor for professional success); the traditional teachers and professors usually drew their prestige from professional work or from cultivated, individual scholarship; and the administration usually did not have the resources, mentality or flexibility to respond to the demands of continuous research which came from this new and emerging group. They had, however, an important thing in common: they all wanted more prestige and resources for the universities, and they all realized, often implicitly, that the presence of science could help them in this direction.

It is possible to divide the years of scientific activism into three general phases or periods. The first, which in the case of Brazil occurred in the years prior to the Second World War, was related to attempts to build new university institutions that could be established around advanced scientific and cultural centers or institutes. The second included more ambitious attempts to completely change the traditional university structures and to give scientific and technological research a central role in social and economic planning. The third involved attempts to create fairly isolated and protected niches for scientific research.

The Brazilian experience before the Second World War was very significant. The university of São Paulo, the largest and most important in the country, was organized in the 1930s with a School of Sciences at its center (called "Faculty of Philosophy, Sciences and Letters") which was intended to conduct research and to train teachers for the secondary schools of the state of São Paulo. The initiative for this project did not come primarily from scientists, however, but from a combination of local intellectuals and the political and economic elite of the state who saw in a first-class university an important element in their quest for a central role in the political life of the country. All of the professors at the new school of sciences were recruited from abroad, and, despite many difficulties, this became the source of some of the most important research traditions that still exist in Brazil. A similar approach was attempted in Rio de Janeiro a couple of years later, with the Universidade do Distrito Federal. There, however, proximity to the central government and the much more obviously liberal ideology of the new institution brought it in sharp confrontation with the country's Church-oriented Ministry of Education, leading to the dosing of the University after its first three years<sup>6</sup>.

These movements towards university reform were quite different from what was commonly known as the "reform movement" in the Latin American universities, which led in the first decades of the century to the institutionalization of student and alumni participation in their administrative bodies. Then, the demands for political participation were paramount, and the students were the more active group; now, science and

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<sup>6</sup> On the Brazilian university projects in the thirties see Antonio Paim, "Por uma Universidade no Rio de Janeiro", in Simon Schwartzman, editor, *Universidades e Instituições Científicas no Rio de Janeiro*, Brasília: Conselho Nacional de Desenvolvimento Científico e Tecnológico, 1982; Simon Schwartzman et al., *Formação da Comunidade Científica no Brasil*. São Paulo and Rio de Janeiro: Cia: Editora Nacional/ FINEP, 1979; and Simon Schwartzman, Helena Bomeny and Vanda Ribeiro Costa, *Tempos de Capanema*, Rio de Janeiro and São Paulo. Ed. Paz e Terra/ EDUSP, 1985.

education in the arts and humanities was at the core of the new initiatives, and a much more active intelligentsia was involved.

Scientific activism gained momentum after the Second World War, but with a few important differences. First, a significant transformation in the ideologies of the scientific intelligentsia had occurred. Before the War, the need for science was proclaimed in the name of culture and civilization. A civilized country had to have music, arts and science, and a place for cultivating them; the university was felt to be this place, and it was not to be geared towards short-term, utilitarian goals. However, the scientists promised that if a central place for science were established, benefits would necessarily be forthcoming sooner or later. After the War the tone had changed. Science began to be perceived as an important tool for economic development and planning, and the scientists began to argue that their social responsibility should not be limited to their academic life; they wanted and felt capable of participating in all of the relevant decisions for their societies. The involvement of scientists in England, the United States and the Soviet Union in the war effort had been followed quite closely, amid the ideas put forward in the previous years by J. D. Bernal and F. Joliot-Curie were well known. Because of that, political participation was generally perceived as a necessary channel for reaching the levels of influence and social responsibility they thought necessary.

Another important change was that the flow of scholars between Latin America and the United States was intensified during the 1940s, as part of the United States' "good neighbors' policy," which replaced at a much higher level the former patterns of exchange with Europe. Now scientists could gain a first hand knowledge of large scale research and get in contact with elite universities which tended to be exceptions in their own country but which became models that were later adopted in Latin America. And finally, as industrialization and urbanization became more intense, the demand for higher education also increased. In the optimistic years of the postwar period, everybody agreed that the future depended on more education, more schools, more scientists, and more research. Thus, demand for more science and university reform became part of the same general movement towards the improvement of higher education and the general modernization of the Latin American countries.

From this point on, two seemingly contradictory but often simultaneous developments occurred. One was the attempt to completely change the traditional university structure, making scientific research its core. The other was to find isolated, protected niches for scientific research, away from the turbulence and pressures of the higher education system.

A reversal of the traditional university structure was a revolutionary proposal. It required breaking the power of the old faculties, imposing demanding patterns of scholarship on students and teachers, placing more value on research work than on professional achievement and discriminating within the higher education system between good and bad universities, departments, research groups and courses. It also meant dividing the students into those who would be oriented towards research and those who would be limited to conventional education for the liberal professions. It would require a complete change of mentality and in the people responsible for running the institutions of higher education. These ideas were

not very new, since they were already present in the universities organized in Brazil during the 1930s. But the power of the traditional faculties could not be curbed at that time, and after the War they aimed at a much larger system of higher education.

Who were the proponents of this revolution? Typically, they were young, bright, rising middle- or upper class people, usually with significant experience of work and study in an advanced, industrialized country, more often than not the United States. They had experienced other cultures and mentalities, and did not accept the prestige hierarchies of their own societies; they were confident in their own ability to change and lead a modernized educational and research system; and they were able to muster enough international and national support to try their ideas out. They believed that their societies would benefit from more science and cease to be backward and underdeveloped. Many also believed that the scientific approach should be put to work not only for the development of new technologies or for the control of tropical diseases, but also for the implementation of social and political planning at the highest possible level. Therefore, their political outlook tended to be rationalistic, nationalist and, quite often, socialist. The opposition developed by this emerging elite against the traditional university establishment coincided very often with the well-known mobilization of the students. The students, however, tended to oppose the higher education institutions for quite different reasons. They wanted more decision-making power in educational and administrative affairs, more social benefits and less scholarly demands. In the last ten or fifteen years in Latin America, a university degree has ceased to be an assured ticket to a comfortable high status and highly paying social position, and the students anticipated their social and professional frustration with total rejection of the values and operating procedures of the universities. They accused the universities of being backward, not concerned with the needs of their country's deprived population, and subservient to the traditional oligarchies - as did their younger, frustrated and best trained teachers. They also charged the universities with being elitist, flooded with Western, imported mentality and technologies - and here the alliance became more complex.

On balance, the attempts at university reform through political mobilization proved very frustrating. In the early 1960s the Facultad de Ciencias Exactas of the University of Buenos Aires became the focus of a very active attempt to change the entire university system in the direction of both high scientific standards amid intense political participation. It clashed, however, with the military regime in 1966; most of its staff resigned from their positions and afterwards even left the country. The University of Brasilia, organized in the early 1960s along the lines of the North American department structure, suffered a similar fate. It was presented as and believed to be an example of the profound university reform the students and intellectuals were pressing for, and the consequence was a series of confrontations with the military regime that did not allow the experiment to continue. In other places and countries, mobilization for university reform tended to remain rhetorical, seldom leading to actual attempts at institutional change. The general climate of political repression that fell over most of the Latin American countries in the 1960s struck the universities particularly harshly, and the idea that they could provide the basis for social change started to look very remote.



The alternative was to try to create isolated and protected niches for scientific research within or, preferably, outside the universities. This was a tendency that had existed all along, but became more pronounced in the 1960s. In the early 1950s, for example, the Brazilian government organized an advanced center for research in physics in Rio de Janeiro which was meant to provide the skills necessary for the country's atomic energy program. Because of the vagaries of that program, however, the Center remained an academic institution without an adequate organizational setting (it was later absorbed by the Brazilian National Research Council). The Argentinian atomic energy program was much more successful (it is certainly the most successful in Latin America)<sup>7</sup> and its research activities were carried on in the tourist town of Bariloche, thousands of kilometers away from Buenos Aires. The ambitious Instituto Venezolano de Investigaciones Cientificas was placed in the mountains outside Caracas, far away from the students, teachers and disturbances of Venezuela's capital. Other examples can certainly be found.

The most comprehensive attempt along these lines, however, was carried out by the Brazilian government from the late 1960s on. It was novel in that resources for scientific and technological research came not from the educational or industrial development authorities, but from the sectors in government responsible for economic planning and long-term investments. This meant, first, that the money available for research was very large compared with the country's research capability and, second, that short-term criteria of efficiency and productivity were seldom applied and used in the evaluation of research activities.

It is possible to link the emergence of this new science policy to a few, influential scientists that retained their faith in the promises of science and technology for social and economic progress. There are also dear links between this policy and the ideas of economic development through self-reliance that have been put forward by the United Nation's Economic Commission for Latin America in the past years, which have gained widespread acceptance among Latin American economists. There was a significant degree of common ground of understanding between these scientists, economic planners and some segments of the military that participated in the government in the name of a policy of national strength and self-reliance.

The dispersion of agencies for scientific and technological development reached most of the Latin American countries during the 1960s, prompted very often by the assistance of international organizations. They were, as often as not, run by professional economists captivated by the ideologies of economic planning and development, and they avoided, whenever possible, getting too involved with the heated politics of the universities.

The consequences of this attempt are many and have not been completely evaluated thus far. For one thing, in just a few years Brazil was able to organize the largest and in many ways strongest research

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<sup>7</sup> For an in-depth comparison of the Brazilian and Argentinian experiences in the field of atomic energy and computer science research, see Emanuel Adler, *A Cultural Theory of Change in International Political Economy: Science, Technology and Computer Policies in Brasil and Argentina*. University of California at Berkeley, Department of Political Science, Ph.D. dissertation, 1982.

establishment in Latin America, making it probably second only to India among the underdeveloped countries. The investment of funds from the economic planning agencies in science and technology coincided with deep transformations in the country's higher education system. The American model of centralized institutes and departmental organization became law in 1968; graduate education started to appear as part of the regular university programs; full-time employment possibilities became available for university teachers on a much larger scale than before. At the same time, entrance requirements at the universities were lowered, and a large parallel system of private schools was allowed to develop in order to compensate for the limited number of places at the public universities. In short, the higher education system became much larger, more differentiated and more stratified than before. Frustrations among the students increased and student political participation and mobilization became subject to extreme forms of repression, particularly between 1969 and 1973.

The new research programs did not fit in well in this changed environment. The reorganization of the universities along these new lines was often troublesome, and the new organizational forms did not necessarily bring about the expected consequences for behavior and performance. Very often, the same traditional power groups within the universities managed to adapt to the new institutional arrangements without losing their strength. The combination of lower entrance requirements and political repression of the undergraduate students created a climate of demoralization that was not conducive, to say the least, to professional scientific work. Moreover, several prestigious scientists that had been among the most outstanding leaders of the comprehensive reform movements of the previous years were expelled from the universities.

The institutional setting for the new programs varied: they included isolated research institutes, new departments within the universities with high levels of autonomy in relation to the central administration, and new and smaller research-oriented universities organized alongside the traditional ones. The new groups which benefitted from the resources now available tended to be young and apolitical, or at least having little memory or personal ties with the recent past. Working in fairly isolated and protected places, getting salaries from independent projects and not from the budgets of the universities and not having to teach undergraduate students, they could think of themselves as long-term reformers waiting for the political storm to wear away and building the foundation for the country's future scientific and technological self-reliance.

### **Scientists under Pressure**

It was impossible, however, to remain isolated amid protected for too long. As the differentiation within the higher education systems increased, the scientists and their protected institutes and laboratories became an obvious target for pressures. Neither the undergraduate students nor their more traditional teachers had much sympathy for these groups of young Ph.Ds. holding foreign degrees, using foreign terms, writing esoteric pieces, being better paid than their colleagues and having a much lighter teaching load. The central administrations of the universities never liked the idea of sizeable funds going directly from the planning

agencies to department heads or research leaders without their participation and approval. The economists in the financing agencies started to become wary of the scientists' continuous requests for resources for long-term, basic research and started to demand more clearly measurable, short-term results. Project evaluation through peer review mechanisms started to be perceived as self-serving for the scientists in the better institutions, leading to progressive concentration of resources in the best and richest centers. Demands for equity on behalf of poorer regions and institutions became common.

Two important factors contributed to the increasing pressures upon the research establishment. The first was the lack of resources for continued growth. In Brazil, the number of research groups and institutions increased very rapidly when money was available, an expansion curtailed very rapidly by the general economic crisis that started to become more evident in the mid 1970s. Other countries with similar experiences of rapid growth - Mexico, Venezuela - have probably suffered the same problems in recent years. Obviously, with increasing demands and dwindling resources, competition emerged both within the scientific establishment and between the scientists and other sectors. At this time, all kinds of alliances were formed. For instance, a relatively weak research group in a small, peripheral university could join forces with the students and the administration of the university against resources being given to high quality research groups at the center. A second factor was the overall improvement of the political climate. In Brazil, as in a few other Latin American countries, the military regimes established around the 1960s in reaction to rising populist politics gradually lost their grip on their societies and started to allow for different forms of political participation and manifestation. The Brazilian state elections of 1982 were fairly free, and several well-known opposition leaders were elected in the main centers of the country; the military regime in Buenos Aires established a calendar for presidential elections; the repressive Uruguayan regime began to ease; how long Pinochet will last in Chile is anyone's guess; and Venezuela has had a fairly democratic political regime for many years.

The reasons for this trend are complex, and cannot be dealt with here. In general, however, it can be suggested that the military regimes met with trouble less because of the mounting pressures from within their societies than because of their own inability to fulfill their avowed social and economic goals with a minimum of competence<sup>8</sup>. The fact is that as the leeway for political participation increased, pressures on university research tended to rise. The volume of contradictory demands on the educational and research policy authorities increased, and their natural inclination was to respond to the larger and more articulate pressure groups - students, teachers' associations, administrative personnel - rather than to researchers. Under these conditions the allocation of resources tends to be related to short-term political considerations, as does the recruitment of administrators for educational and research policy agencies. Criteria of social regional and even racial equality or convenience may take priority over criteria of performance and

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<sup>8</sup> There is a growing literature on the current breakdown of authoritarian regimes in Latin America. See, among others, Fernando Henrique Cardoso, "Os Impasses do Regime Autoritário: O Caso Brasileiro", *Estudos CEBRAP*, n. 26, 1980, pp. 173-194; and Sergio Henrique Abranches, "Crise e Transição: uma Interpretação do Momento Político Nacional", *Dados - Revista de Ciências Sociais*, vol.25, 3, 1982, pp. 307-330.

excellence, and the scientists may find it harder and harder to justify the money and freedom they feel they need.

### **In Search of a New Role**

The scientific community is therefore faced with a serious dilemma. On the one hand, it would prefer to have more freedom for research and less interference in its work from bureaucrats, administrators. Rectors and planning authorities. On the other, its members, more often than not, share the basic values of democracy, social participation, equality and socioeconomic development that threaten their own work. Their challenge is to find a way to redefine their social role and combine the two goals. They have tried to do this in different ways.

A common approach is to try to increase the presence of scientists in their country's decision-making bodies. This is, of course, the classic Bernalist approach: to place scientists as high up in government as possible and to emphasize the need for comprehensive planning and the integration of science and technology, applied and basic or pure research. The political and social bases of their governments do not seem to be very important. In Brazil, scientists who spoke in favor of a ministry of science and technology in the 1950s continued to do so in the 1960s and 1970s, in spite of the profound change in the country's political regime and the personal repression many of them suffered. The idea that a centralized system of science planning would increase the bureaucracy, give basic research lower priority and in the end remove the scientists from participation in the decisions related to their work does not seem to bother those who advocate this option. They quite probably believe that they would be the ones to be called on to run the powerful planning agendas they are pressing for and that there is something inherently good in central planning and coordination. They certainly also believe that if decisions about science were taken at the highest political level, they would be freed from the day-to-day pressures to which they are presently subjected.

The other approach is to make their own research more directly relevant for society. The selection of research topics based on their short-term social and economic impact, involvement with local community groups and an increasing willingness to participate in undergraduate teaching are movements in this direction. Quite often this approach is combined with a strong rejection of the assumptions of "universal science" and their corollaries: the value of scientific research for its own sake, the importance of publishing in international journals, the prestige attached to formal degrees and the standard evaluation mechanisms of research work - peer groups, external referees, citation analyses, etc.

An extreme form of this approach can be found in some "softer" areas such as educational research, where "action research" has become a catchword and research proposals are often justified in terms of the supposed inseparability of theory and practice, knowledge and action, science and ideology. The contradiction between this way of looking at research work and the more elitist approaches described above are quite obvious and tend to be compounded by the traditional rejection of natural and "hard" scientists towards the scientific pretensions of their colleagues in the social fields.

A third approach, common among science administrators, is to press for closer links between the research system and industry. When this view prevails, projects are selected and have better chances of being supported if they lead to clearly defined products, and institutional arrangements are devised to put the research resources of the universities at the service of the industrial sector. At the same time, mechanisms are sought to facilitate the movement of scientists between the two environments. In a few sectors, linkages are sought not with private industry but with government, including the military establishment. In practice, several case studies have shown that this is not an easy marriage. University researchers and industrialists speak different languages and work according to quite distinct goals and rhythms, and only in special circumstances can they establish a permanent working relationship. This is not, of course, particular to Latin America, but there is a tendency in this region to assume that the integration between universities and industry works quite smoothly in the developed countries and to try to emulate it.

The approaches described so far are "ideal types" which in real life occur in different combinations. In fact, scientists tend very often to assume contradictory images of their own field and social role. A good example of this is found in the answers given to a questionnaire presented to a group of top biological researchers from Latin America during an international conference held in Rio de Janeiro in 1979<sup>9</sup>. They tended to agree that biologists should not be called upon to contribute directly to the solution of the practical problems of their societies. They wanted to preserve their autonomy and freedom of research and did not like the idea of being subject to priorities established elsewhere. Most of them did not like the current priorities for biological research in the region but did not agree on what the priorities should be. In fact, their perception of what the present priorities were and what they should be did not differ significantly; first, the formation of human resources; second, to contribute to the advancement of scientific knowledge; and only third, to contribute to the solution of current social problems. When asked, however, about the practical contributions their work could make to their societies, they were ready to provide a list of items ranging from endemic diseases to nutrition, agricultural production and pharmacology. The lack of correspondence between these supposed contributions amid their actual priorities seems to be an indication that their belief in the social and economic relevance of their work does not have a direct influence on what they actually do as researchers or as people involved in shaping the science policies in their own field.

What have been the effects of the efforts to redefine the role of scientists in the university research system and in scientific research as a whole? One positive consequence has been that the traditional justifications for supporting scientific research have become very difficult to maintain. Today very few people still talk about the ideals of free research guided only by each scientist's personal preferences amid the invisible hand of the scientific market. By the same token, it is not easy to argue that scientists are in possession of the key to a better future and should, therefore, receive all the resources and the political power they demand. It is now clear that the role of the scientists is more limited and more subject to social, economic

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<sup>9</sup> Thirty-one scientists from seven Latin American countries, half of them from Brazil, answered the questionnaires administered and analyzed by this author.

and political constraints and that consideration of social needs, economic relevance, comparative advantages, and so on could guide a competent scientific community toward a more scientifically realistic and more socially significant goals. This could, in turn, bring to the scientific community more social prestige, influence and, thus, the ability to obtain greater resources.

At the same time, this is fertile ground for incompetence and mystification. The traditional Mertonian model for the organization of the scientific community provided it with built-in mechanisms for quality control in spite of its obvious limitations (for instance, it was much more appropriated for basic and "hard" sciences than for fields which are more technological or which do not have a well-established paradigm. The rapid growth of scientific institutions in contexts without a previous tradition of academic institutions is bound to generate a sizeable number of professionals, institutions and research groups that would not survive in a more demanding scientific environment. There is a natural competition between these emerging groups amid the older, more established amid competent scientific sectors. When the traditional mechanisms of peer review function, the more competent groups are more likely to prevail in the competition over scarce resources. When other criteria and other participants enter the decision making process, this situation can be reversed. New, less firmly established research groups are more likely to adopt untested methodologies to look for short-term practical results and to embark on contract research of an uncertain nature than people amid institutions having a longer tradition of competence at stake. A conflict which expresses itself in terms of values of social concern equality, innovation, interdisciplinarity, etc. vs. elitism, conservatism, academism and rigidity may in fact hide a much simpler and more elementary conflict between competence, on the one hand and incompetence and intellectual opportunism on the other. However in some instances the rhetoric may in fact correspond to reality. It is equally difficult and crucial to distinguish these different types of conflict from each other. The outcome of the current situation is not easily predicted. It is possible that the fragile scientific community formed in many Latin American countries over the past ten or twenty years will simply not be able to redefine its role amid will therefore succumb to the current combination of diminishing resources and increasing pressures. There is also a chance that a renewed appreciation of the values of scholarship, freedom of research and intellectual independence will give it more breathing space, at least in some areas and countries. For this to happen, however, it will be necessary to bridge the gap and find a point of equilibrium between the old faith in the neutrality and natural goodness of science and the utilitarian view. The simple juxtaposition of the two is a solution that will probably not be able to last for much longer. A much more complex ideology of the role of scientific research in these (amid other) societies is needed, and this is, I believe, the biggest challenge of all.